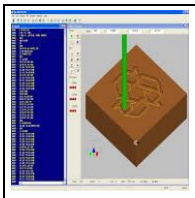
Government of Karnataka
Department of Technical Education
Board of Technical Examinations, Bangalore

	Course Title: **CNC LAB**		
	Scheme (L:T:P) : **0:2:4**	Total Contact Hours: **78**	Course Code: **15ME64P**
	Type of Course: **Tutorial and practice**	Credit **:03**	Core/ Elective: **Core(practice)**
CIE:25 Marks			SEE:50 Marks

Prerequisites: Learning concepts of Computer Integrated manufacturing

Course Objectives:

1. By undergoing this lab the students will learn to use the CNC machines efficiently for manufacturing desired products and knowledge of programming and use of CNC tooling

Course Out comes

Students *On successful completion of the course, the students will be able to attain CO:*

Course Outcome		CL	Linked experiments	Linked PO	Teaching Hrs
CO1	Appreciate the importance of CNC lathe and CNC Milling machines	***U/A***	1-10	2,3,4	**18**
CO2	Understand the codes (G-code and M-Code) used in CNC machines for programming	***U/A***	1-10	2,3,4	**15**
CO3	Develop Programming skills and crate an component for required drawing, Simulate the prepared part programme using available simulation software's. And Prepare the parts on CNC	***U/A***	1-10	2,3,4	**27**
Total sessions					**78**

Legend: U: Understand A: application

COURSE-PO ATTAINMENT MATRIX

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
CNC LAB	**0**	**3**	**3**	**3**	**0**	**0**	**0**	**0**	**0**	**0**

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.
Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.
If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

LIST OF GRADED PRACTICAL EXERCISES

The practical/Graded exercises should be properly designed and implemented with an attempt to develop different types of learning out comes in affective domain and psychomotor domain, so that students are able to acquire the necessary skills. Following is the list of experiments to be carried out.

Exercise No.	Practical/Exercise	Apprx. Hrs. Required
PART A. CNC turning centre part programming *Students would:* a. Sketch each part with dimensions. b. Prepare CNC part programme using G and M codes with ISO format. C.Show various zeros and tool path on part sketch with color codes and dimensions. d. Simulate the prepared part programme using available simulation software's. e. Prepare the parts on CNC		
1	Develop a part program for step turning and simulate	06
2	Develop a part program for taper turning and simulate	06
3.	Develop a part program for circular interpolation and simulate	06
4	Develop a part program for multiple turning operation and simulate	06
5	Develop a part program for thread cutting, grooving and simulate	06
6	Develop a part program for internal drills, boring and simulate	06
PART- B. CNC machining centre part programming *Students would:* a. Sketch each part with dimensions. b. Prepare CNC part programme using G and M codes with ISO format. C. Show various zeros and tool path on part sketch with color codes and dimensions. d. Simulate the prepared part programme using available simulation software's. e. Prepare the parts on CNC		
7	Develop a part program for grooving and simulate on CNC Milling	09
8	Develop a part program for drilling (canned cycle) and simulate	09
9	Develop a part program for mirroring with subroutines and simulate	12
10	Develop a part program for rectangular and circular pocketing and simulate	12
	TOTAL	**78**

TEXT BOOKS & REFERENCE

S. No.	Title of Book	Author	Publication
1	CNC Machines.	Pabla B.S., Adithan M.	New Age International, New Delhi,2014(reprint).
2	CAD/CAM: computer aided design and manufacturing.	Groover Mikell P, Zimmered W Emory	Prentice Hall 2014.
3	Computer Numerical Control-Turning and Machining centers.	Quesada Robert	Prentice Hall 2014.
4	CAD/CAM.	Sareen Kuldeep	S.Chand 2012.
5	Introduction to NC/CNC Machines.	Vishal S.	S.K.Kataria & Sons. 2012.
6	Computer Aided Manufacturing.	Rao P N, Tiwari N K, Kundra T	Tata McGraw Hill 2014.

SUGGESTED LEARNING RESOURCES

- http://www.nptel.ac.in
- http://www.youtube.com/watch?v=M3eX2PKM1RI
- http://www.youtube.com/watch?v=EHQ4QIDqENI&list=PLBkqkLQO2nAt5
- http://www.youtube.com/watch?v=hJFLcvtiNQI
- http://www.youtube.com/watch?v=BIM1AyxfYkw .
- http://www.mtabindia.com
- http://www.swansoftcncsimulator.com

SUGGESTED LIST OF STUDENT ACTIVITES

1. Each student should submit any one of the following type activity or any other similar activity related to the course and before take up get it approved from concerned Teacher and HOD.
2. Each student should conduct different activity and no repeating should occur

1	Visit nearby industry having CNC machines. List and state important features of them with detail specifications and name of manufacturers.
2	Download free simulation software's available on website and practice for part programming
3	At least take two simple mechanical components likes step turned shaft, sleeve, muff measure the dimensions, prepare the sketch and develop part program, then simulate

Course Delivery:

The course will be delivered through specific instructional strategies detailed as below

S.N.	Unit Name	Strategies
1	Introduction.	Videos, Presentations, Demonstration.
2	CNC Turning & Machining Centers..	Videos, Presentations, Industrial Visits, Demonstration,
3	CNC part programming.	Simulation software, actual practice on CNC machines, Demonstration,

Course Assessment and Evaluation Scheme:

Method	What		To whom	When/Where (Frequency in the course)	Max Marks	Evidence collected	Course outcomes
DIRECT ASSESSMENT	**CIE** (Continuous Internal Evaluation)	**IA** Tests	Students	Two Tests (Average of two tests to be computed)	10	Blue books	1,2,3
				Record Writing (Average marks of each exercise to be computed)	10	Record Book	1,2,3
				Activity	05	Report	1,2,3
				TOTAL	25		
	SEE (Semester End Examination)	End Exam		End of the course	50	Answer scripts at BTE	1,2,3
INDIRECT ASSESSMENT	Student Feedback on course		Students	Middle of the course		Feedback forms	1,2,3, Delivery of course
	End of Course Survey			End of the course		Questionnaires	1,2,3 Effectiveness of Delivery of instructions & Assessment Methods

- **MODEL OF RUBRICS /CRITERIA FOR ASSESSING STUDENT ACTIVITY**

RUBRICS MODEL

RUBRICS FOR ACTIVITY(5 Marks)						
Dimension	**Unsatisfactory**	**Developing**	**Satisfactory**	**Good**	**Exemplary**	**Student Score**
	1	**2**	**3**	**4**	**5**	
Collection of data	Does not collect any information relating to the topic	Collects very limited information; some relate to the topic	Collect much information; but very limited relate to the topic	Collects some basic information; most refer to the topic	Collects a great deal of information; all refer to the topic	Ex: 4
Fulfill team's roles & duties	Does not perform any duties assigned to the team role	Performs very little duties but unreliable.	Performs very little duties	Performs nearly all duties	Performs all duties of assigned team roles	5
Shares work equally	Always relies on others to do the work	Rarely does the assigned work; often needs reminding	Usually does the assigned work; rarely needs reminding	Normally does the assigned work	Always does the assigned work without having to be reminded.	3
Listen to other Team mates	Is always talking; never allows anyone else to speak	Usually does most of the talking; rarely allows others to speak	Talks good; but never show interest in listening others	Listens, but sometimes talk too much	Listens and speaks a fair amount	2
Average / Total marks=(4+5+3+2)/4=14/4=3.5=4						

Note: This is only an example. Appropriate rubrics/criteria may be devised by the concerned faculty (Course Coordinator) for assessing the performed activity.

Note to IA verifier: ***The following documents to be verified by CIE verifier at the end of semester***

1. Blue books (20 marks)
2. Student suggested activities report for 5 marks
3. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Method

Scheme of Valuation for End Examination

Serial no	Description	Marks	
1	**Part A – CNC Turning** **Writing**	10	**20**
	Execution	10	
1	**Part B – CNC Milling** **Writing**	10	**25**
	Execution	15	
3	**Viva**		**5**
		TOTAL	**50**

EQUIPMENT LIST: Quantity: 01 Each

Sr. No.	Resource with brief specification
1	CNC Turning Centre (Tutor or Productive)- Minimum diameter 25 mm, Length 120 mm with ATC. (Approximate)
2	CNC Machining Centre (Tutor or Productive)- X axis travel - 225 mm, Y axis travel - 150 mm, Z axis travel - 115 mm, With ATC.(Approximate)
3	Simulation software likes: CNC Simulator Pro, Swansoft CNC, etc.
4	Latest version of CAD/CAM integration software like MASTER CAM, NX CAM